# REPORT

# SITE INVESTIGATION
# OIL STORAGE TANK AREA

## ARMCO KANSAS CITY WORKS
## KANSAS CITY, MISSOURI

**PREPARED FOR**

ARMCO INC.
KANSAS CITY, MISSOURI

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PROJECT NO. 89118



REMCOR, INC.
PITTSBURGH, PENNSYLVANIA

*"REALISTIC SOLUTIONS FOR HAZARDOUS WASTE PROBLEMS"*

REMCOR

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# 1.0 INTRODUCTION

Under contract to Armco Inc. (Armco), Remcor, Inc. (Remcor) has conducted an evaluation of the area associated with the formerly used oil storage tank south of U.S. Highway 24 at the Armco Kansas City Works in Kansas City, Missouri (Figure 1). The investigation was conducted to evaluate the current conditions of this area with respect to the reported presence of petroleum hydrocarbon (PHC) contamination along the right bank of the (Big) Blue River.

This study has involved drilling and subsurface sampling, as well as the compilation of previously collected site data. Such data include information from the U.S. Army Corps of Engineers (COE), Kansas City District, regarding the rechannelization of the adjacent Blue River. Corrective measures to abate potential oil and grease (O/G) discharges to the river were also evaluated.

This investigation was conducted by Remcor during the period of May 1 through 5, 1989. This report presents the findings of the investigation conducted at the site, as well as a description of the proposed corrective measure.

## 1.1 BACKGROUND

As the rechannelization work for the Blue River has proceeded, the COE identified apparent PHC contamination in certain bank soils. The right bank between river Stations 518+00 and 522+50 was identified by COE subcontractors as potentially contaminated by oil. This area (approximately 2.5 acres) is adjacent to a formerly used oil storage tank owned by Armco (Figure 2).

### 1.1.1 Tank Description

The oil storage tank at the Armco facility measures approximately 60 feet in diameter by 40 feet high with a nominal capacity of 20,000 barrels (840,000 gallons). The tank was installed in 1951 and removed from service in 1982. Most recently the tank was used to store No. 2 fuel

oil, but had contained No. 6 fuel oil before 1962. Currently the tank is empty, and the associated product transfer stations have been abandoned.

The oil unloading platform area was formerly used to transfer product from rail cars for distribution. Adjacent to the oil unloading platform was a surface drain with a 12-inch pipe discharging to the bank of the Blue River. A 10-inch diameter pipe associated with the containment dike around the tank also discharged to the bank of the Blue River.

### 1.1.2 Results of Past Sampling

During November and December 1988, the COE collected soil samples in the river bank area near the Armco tank. These samples were analyzed for the following:

- pH
- Volatile organic compounds (VOCs) (including benzene, toluene, and xylene [BTX])
- Base/neutral and acid extractable (BNA) compounds
- Polychlorinated biphenyls (PCBs)
- PHC
- O/G.

Analytical results showed PHC concentrations ranging from 161 to 827 milligrams per kilogram (mg/kg) and O/G concentrations ranging from 240 to 991 mg/kg. No PCBs were detected, and VOCs (attributable to PHC presence) were detected only in the one sample with the highest PHC and O/G concentrations. These analytical data are summarized in Table 1.

Analysis of BNA compounds was also performed on the sample with the highest O/G concentration. This analysis indicated the presence of base neutral semi-volatile compounds related to the presence of free hydrocarbons. These compounds are listed in the laboratory data sheets included as Appendix A. None of the acid extractable semi-volatile compounds (i.e., phenols) was detected in this analysis.

Additional soil samples were subsequently collected by the COE from nine borings installed during the period of December 29, 1988 through January 10, 1989. These samples were analyzed for PHC and O/G only. Analytical results indicated PHC concentrations ranging to 8,700 mg/kg and O/G concentrations ranging to 9,500 mg/kg. A "fingerprinting" process was used to determine that the source of the PHC and O/G contamination was primarily No. 6 fuel oil in both weathered and unweathered states; some No. 2 fuel oil was present as well. These sample results are also included in Table 1.

The Missouri Department of Natural Resources (MDNR) was notified of the COE findings and suggested that Armco investigate the possibility of this contamination originating at the Armco-owned storage tank. The following sections describe the investigation that Remcor implemented on Armco's behalf.

# 2.0 PROJECT OBJECTIVES

The Remcor investigation focused on the determination of the source of PHC found in the COE work area and potential relationship to the above-ground oil tank. Borings were located to give evidence to the origins of the PHC, as well as to give indications of subsurface conditions at the site. All but one of the borings were located proximal to the oil unloading platform and the permanent river channel right-of-way (Figure 2).

## 2.1 INVESTIGATION METHODS

### 2.1.1 Test Borings and Soil Sampling

Twelve shallow test borings were advanced by a small geotechnical drill rig utilizing hollow-stem augers and split-spoon samplers. Split-spoon samples were collected in accordance with the American Society for Testing and Materials (ASTM) Method D 1586-74, and standard penetration resistance (SPR) was recorded. Each split-spoon sample was visually identified in accordance with the Unified Soil Classification System (USCS) by the on-site Remcor geologist. Boring logs were developed to include the SPR, as well as USCS classification; these boring logs are included in Appendix B.

To reduce the potential for cross contamination of samples, split-spoon samplers were thoroughly decontaminated prior to each use. Laboratory detergent and water were used to wash the split-spoon samplers, and they were then rinsed with clean water. Other downhole equipment, which could not be decontaminated by the above method, were steam cleaned prior to each use.

Soil samples were screened in the field for the presence of oil by submersing a small aliquot of sample in a jar of water and observing for the presence of an oil sheen. This simple screening method aided in the selection of samples for laboratory analysis.

During the COE investigations, both total PHC and O/G were analyzed in each sample. Due to the excellent correlation between PHC and O/G, Remcor elected to analyze O/G only for each sample. Figure 3 shows the relationship between O/G and PHC. During the Remcor investigation, a total of 32 samples were collected from borings located in the oil unloading platform area and analyzed for O/G. Nine of these soil samples were also analyzed for extraction procedure (EP) toxic chromium and lead.

Each of the soil samples (for analysis) was collected into a laboratory-prepared 250-milliliter (mℓ) glass sample jar with a Teflon®-lined lid. The sample label affixed to each jar contained the following information:

- Sample identification number
- Client name (Remcor) and project number
- Date and time of sample collection
- Boring number and sample depth
- Analytical suite
- Sampler's initials.

Each sample was assigned a unique sample number that could identify the Remcor project, as well as boring number and a sequential digit referring to the number of samples collected at the boring. Each sample was subsequentially logged onto a chain-of-custody form. Chain-of-custody protocols were strictly followed in accordance with standard procedures employed by Remcor. Samples were then placed into a cooler for shipment to the analytical laboratory.

### 2.1.2 Shallow Test Pits

Four shallow test pits (i.e., TP-1 through TP-4) were located in the COE work area (Figure 2) to evaluate the presence of free hydrocarbons on top of the ground water table. These test pits were each excavated by hand to an approximate depth of 1.0 feet. No soil samples were collected from the test pits. An oil sample was collected from Test Pit TP-1 and analyzed for EP toxic chromium and lead.

# 3.0 SITE CHARACTERIZATION

This chapter presents the findings of the site investigation. The regional setting is first described based on reports by the U.S. Department of the Interior, Geological Survey (USGS) and the MDNR. The site-specific conditions in the oil tank area are then discussed.

## 3.1 REGIONAL SETTING

The following sections outline important aspects of the regional environmental setting.

### 3.1.1 Topography and Drainage

The Kansas City, Missouri region is an area of rolling and plain topography with dendritic streams of mature developmental stage (McCourt, et al., 1917). Stream valleys are wide and flat-bottomed; meandering streams and oxbow lakes are common.

At Kansas City, the average discharge of the Missouri River is 51,000 cubic feet per second (cfs) (Jordan, 1984). In comparison, the average discharge of the Blue River, near its confluence with the Missouri, is on the order of 200 cfs (Waite, 1987). The approximate 100-year flood elevation of the Missouri River at Kansas City is 738 feet mean sea level (ft-msl). Because the flow of the Missouri River is highly regulated in this area, a 100-year flood may be the function of regulation and not runoff. For this reason, the USGS is reluctant to recognize an official 100-year flood elevation (Waite, 1987). Flood elevations along the Blue River are not available due to ongoing rechannelization efforts.

### 3.1.2 Geology

The site region is part of the Osage Plains portion of the Interior Plains physiographic province (Emmett, 1985; Anderson, et al., 1979), located midway between the Ozark Plateau and the Great Plains (McCourt, et al., 1917). The geology of the Osage Plains is relatively uncomplicated, predominated by relatively flat-lying sedimentary rocks (dipping

10 to 20 feet per mile to the west-northwest) and unconsolidated alluvial deposits in the valleys (Parizek, et al., 1968).

Figure 4 is a generalized geologic cross section through the site area. As illustrated in this figure, five geologic units are present in this area (Parizek, et al., 1968):

- Marmaton Group
- Pleasanton Group
- Kansas City Group - Bronson Subgroup
- Kansas City Group - Linn Subgroup
- Blue River Alluvium.

These units are Pennsylvanian in age, except for the alluvium, which is of the Quaternary period.

The oldest bedrock unit of these listed, the Marmaton Group, consists of an upper shale, median limestone, and basal sandstone (Anderson, 1979). According to Parizek, et al. (1968), this unit is present at a depth of approximately 100 feet below the ground surface in the area of the Kansas City Works (Figure 4).

Overlying the Marmaton is the Pleasanton Group, comprised of argillaceous to sandy, micaceous shale. Thin, fossiliferous siltstone beds are also present in upper portions of the group (Parizek, et al., 1968). This unit is exposed in the vicinity of the Blue River near the Armco facility. The upper surface of this unit appears to be at the approximate elevation of Interstate 435 (I-435) to the southeast of the site, based on visual identification by Remcor.

The bedrock units lying above the Pleasanton Group consist of the Bronson and Linn Subgroups of the Kansas City Group. Both of these members of the Kansas City Group have been removed by erosion in the vicinity of the Armco facility. The Bronson Subgroup consists of a cyclic sequence of three major limestones separated by shale and clay units. The limestones are commonly quarried, but also deep-mined in areas of high-quality material. These mining methods have left mine adits, which have

been used by some industries for various purposes. The Linn Subgroup consists of shales, a few persistent limestones, and some thin sandstones.

Locally derived alluvium lines the valley bottom along the Blue River. Near the Armco facility, this material may be as much as 30 feet thick (Parizek, et al., 1968). Based on data provided by exploratory geotechnical drilling performed for the COE in preparation for the Blue River rechannelization project (COE, 1983), the natural alluvial deposits consist primarily of high- and low-plasticity clays (CH and CL). Sandy clays (SC) and poorly graded sands (SP) exist at depth, buried by the clayey and silty surface materials.

### 3.1.3 Hydrogeology

Aquifers of the site region may occur in either bedrock or unconsolidated materials. Bedrock aquifers typically consist of sandstones, where permeability is controlled by primary porosity, or within limestone, where permeability is generally a function of the density and interconnection of fractures. Typical yields from domestic wells tapping the bedrock aquifer(s) range to less than 20 gallons per minute (gpm) (Imes, 1987). Near major rivers, these bedrock aquifers are not commonly used for domestic, industrial, or municipal water supplies. Unconsolidated formations, such as glacial drift, are relatively unimportant as aquifers in the Kansas City area. These drift deposits are typically thin mantles of silty clay material that transmit very little water.

Deposits of alluvium along major rivers (e.g., Missouri River) are widely used for water supply by both industry and individuals. Wells developed in these deposits commonly yield on the order of several thousand gpm (Emmett, 1985). Ground water is typically encountered at shallow depths (less than 20 feet) with flow directions toward and in the downstream direction of the alluvial valleys.

## 3.2 SITE SUBSURFACE CONDITIONS

Subsurface data were available from the 11 borings located at and adjacent to the oil unloading platform area, as well as from one boring located approximately 300 feet west of the investigation area. The boring logs from these borings indicate the presence of the following stratigraphic sequence:

- Mill scale fill
- Steel mill slag fill
- Steel mill slag mixed with silt fill
- Silt and clay (Blue River Alluvium).

Figure 5 shows a site-specific cross section extending from the western boring to the Blue River. The topographic profile (shown at a 5× vertical exaggeration) was developed from both field observations and COE rechannelization design drawings with relative elevations (in feet) above an arbitrary datum. Several borings that provide key data have been projected to the cross section. The 12-inch drain pipe from the oil handling area is also shown in perspective on the section.

Ground water was encountered under phreatic conditions across the site and found to be discharging toward the Blue River. Some low-lying areas in the COE work area were found to show ground water seeps. These seeps were located near the lower contact of the fill materials. Ground water recharge to the water table is west of the site. In the immediate vicinity of the oil unloading platform, ground water discharges from the lower portion of the steel mill scale and scale with silt fill materials to the Blue River Alluvium.

Based on visual identification of the fill materials and the alluvium, the difference in hydraulic conductivities is believed to be as much as three orders of magnitude (Freeze and Cherry, 1979). The fill material is generally a sandy to coarse-grain scale, which, in its lower portions, is mixed with various amounts of silt. The alluvial material is dominated by silt with clay, showing some sand to sandy lenses and abundant plant remains (Appendix B).

Samples collected from each of the borings in the oil unloading platform area are listed in Table 2. In addition to analytical results, the table lists each sample, depth sampled, material sampled, and the stratigraphic relationships to the water table.

## 3.3 ANALYTICAL RESULTS

### 3.3.1 Oil Unloading Platform Area

Five borings (i.e., TB-1, TB-2, TB-4, TB-11, TB-12) were drilled on Armco property into the slag fill area around the oil unloading platform. Due to the extremely dense nature of the fill, only one boring (TB-1B) could be advanced completely through the fill. Whenever refusal was encountered before the objectives of the boring were met, another boring was drilled in the immediate area and identified with the same boring number and a letter suffix.

Soil samples collected at these borings indicate the overlying mill scale to contain concentrations of O/G less than 0.1 percent. The sample collected from 0.0 to 0.8 feet at TB-1 showed 7,700 micrograms per gram (µg/g) O/G. At a depth of 8.0 to 9.0 feet (in the unsaturated zone), the O/G concentration in a sand fill was 63 µg/g. The dense slag fill at the water table in the same boring showed 2,300 µg/g O/G, nondetectable EP toxic chromium, and 0.1 milligram per liter (mg/ℓ) EP toxic lead. Deeper samples (below the water table) showed 95 and 53 µg/g O/G, respectively. Borings TB-4 and TB-11 were each attempted to be advanced to the water table; however, auger refusal was met in each before encountering water. Samples from these borings were each collected between 3.0 and 5.0 feet, and results showed O/G from 110 to 170 µg/g.

Borings TB-2 and TB-12 were advanced to depths of 11.0 and 9.0 feet, respectively. Based on the log of TB-2, ground water is believed to exist at a depth of approximately 9 feet (Figure 5). Samples from TB-2 collected at depths of 3.0 to 4.0 feet and 10.0 to 11.0 feet showed O/G concentrations of 200 and 100 µg/g, respectively; the EP toxicity result of 0.4 mg/ℓ lead was found in the 10.0- to 11.0-foot sample. The sample

collected at TB-12 at a depth of 6.0 to 9.0 feet showed O/G concentrations of 2,500 µg/g. Because split-spoon samplers could not be driven at this location, this sample was collected from the augers; it is believed to be representative of the materials between 6.0 and 9.0 feet (immediately above the water table). Observations of water levels and determinations of whether floating product exists could not be made at Borings TB-2 or TB-12.

As illustrated in the cross section (Figure 5), the bottom of the fill occurs at a maximum thickness of 15.5 feet over a gray silt or silty clay alluvium. At the western limit of the facility, the fill is approximately 4 feet thick based on the log from the boring located in that area.

The pattern of subsurface O/G concentrations in the oil unloading platform area suggests historic surface spillage of petroleum products. These materials would then migrate downward and tend to accumulate (in the fill) at the ground water table.

### 3.3.2 River Bank Area

Borings TB-5 through TB-10 were installed along the right bank of the Blue River on the city of Kansas City property. The borings were placed in a line from south to north at relatively equal spacing (Figure 2). Each boring was advanced to a depth of 8.0 to 12.0 feet (at least 5 feet below the top of the water-bearing zone). A total of 21 soil samples was collected from these borings and analyzed for O/G, six of which were analyzed for EP toxic chromium and lead. EP toxicity analysis showed detectable lead at Borings TB-6, TB-7, and TB-9 ranging from 0.1 mg/ℓ to 0.3 mg/ℓ and no detectable chromium.

Results of analyses of seven samples collected at Borings TB-5 and TB-6, the southernmost borings, showed O/G levels from nondetectable to 480 µg/g. Water levels were observed at these two borings and indicated only very faint oil sheens. These water levels were found to rise approximately 1.5 feet after drilling.

Boring TB-7 appears to represent the southern limit of significant O/G contamination at the site. Although O/G levels in the soil were relatively low (ranging to 370 µg/g), a thin layer of light oil was observed on the water table. As with Borings TB-5 and TB-6, the water level in TB-7 was found to rise approximately 1.5 feet after drilling.

Boring TB-8 was logged to have a zone of oil-saturated soil approximately 1.5 feet thick. A soil sample collected from this zone showed 4,000 µg/g O/G. To assess the quantity of floating product, a special piezometer was installed to measure the thickness of the free oil. The construction details of this piezometer are shown in Appendix C. Measurements made at this piezometer, approximately 24 hours after its installation, indicated approximately 1 inch of oil floating on the water table. It was uncertain, however, whether this measurement was made under static (equilibrium) conditions, and an additional measurement was made after one month. This second measurement indicated an approximate accumulation of 1.5 inches of product. Since the design of this piezometer is not susceptible to oil accumulation amplification associated with conventional piezometers, these oil thicknesses are believed to represent the thickness of product on the aquifer.

In Boring TB-9, ground water with free oil was encountered at approximately 1.0 foot. The soil sample collected at this level showed 4,300 µg/g; samples collected at lower depths (below the water table) showed less than 50 µg/g (7.0 to 8.0 feet) and 280 µg/g (10.0 to 11.0 feet).

Test Boring TB-10 was advanced to a depth of 8.0 feet, and four samples were collected for analysis. Only one of these samples, 3.0 to 4.0 feet, showed any detectable O/G (110 µg/g). Data presented by this boring in conjunction with Test Pit TP-3 indicate the northern limit of the area of O/G contamination as shown in Figure 6.

Borings TB-8 and TB-9 were placed upgradient of the discharge point for the 12-inch drain pipe from the oil unloading platform area. Because free product was found at this boring location, it appears that surface

spillage of product in the oil unloading platform area, rather than the pipe discharge, is the source of the encountered O/G.

Four shallow (less than 1.0 foot) test pits were then excavated to determine the northern limit of free product on the aquifer (Figure 2). Test Pits TP-1, TP-2, and TP-4 were each found to show evidence of free oil. The oil located in this area was thick and heavy compared to the relatively thin oil found in Boring TB-7, TB-8, and TB-9. A sample of this oil was collected at TP-1 and analyzed for EP toxicity chromium and lead and found to have no detectable trace of either metal (Table 2).

# 4.0 PROPOSED CORRECTIVE MEASURES

This chapter discusses the proposed corrective measures to address the accumulation of minor amounts of free product on top of the aquifer at the oil unloading platform area.

## 4.1 WORK PLAN

### 4.1.1 Well Installation

Remcor will subcontract a local drilling company to mobilize to the Armco site for installation of one 6-inch diameter recovery well and two 6-inch diameter oil detecting wells. These detection wells could later be fitted with oil recovery pump systems if testing indicates recovery is required at these locations. Figure 7 shows the proposed locations of these wells based on the data available from this investigation.

The recovery well will be constructed of 6-inch polyvinyl chloride (PVC) continuous wrapped screen not less than 0.020-inch slot. The pumping well will be drilled to a depth of approximately 8 to 10 feet below the water table to facilitate the ground water table depression. The 6-inch oil detecting wells will be located 80 to 100 feet north and south of the pumping well and constructed similar to the pumping well with 1-inch PVC inner pipes similar to the in-place oil detecting piezometer (Appendix C). This method provides wells suitable for product recovery (should they become necessary) without incurring an additional drilling program. Fitting of these wells with a 1-inch PVC drop-pipe will not preclude their use as pumping wells because the pumps intended for use are designed for use in 4-inch diameter wells.

The pumping well will be outfitted with a pump specifically designed for recovery of floating product by pumpage of total fluids. The pump system will be fitted with a control panel to provide either automated or manual control to allow continuous pumping. Since drawing the water level down below the intake of the pump may result in damage to the system, the automated operation mode will be a desirable feature.

4.1.2 Pumping Tests

After installation of the system, the on-site Remcor geologist will initiate a pumping test to establish the optimum pumping rate. The effects of the system will be monitored at the monitoring points established by the two additional six-inch wells to the north and south and the in-place oil detecting piezometer to the east. Water levels, drawdown, and change in oil thickness will each be monitored in the observation wells during pumping of the recovery well. Because the permeability and transmissivity of the aquifer have not yet been defined; at this time, estimates of pumping rates are preliminary. It is expected that pumping rates will be on the order of 3 to 5 gpm. The installation of the observation wells will provide data on cone of depression created by pumping. At this time, it is anticipated that the pump shutoff switch will be located at the level of the bottom of the fill materials.

4.1.3 Operations

The collected oil product and associated ground water will be piped into Armco's wastewater treatment system. Access to this system will be provided at the nearby overhead pipeline. The treatment system currently handles a flow of approximately 18,000 gpm; the estimated increase to this system as a result of pumping the recovery well is estimated to be well less than 10 gpm. In the event the additional two wells would be needed for recovery, each would contribute an additional flow less than 10 gpm.

The pumping well will be monitored during this process by use of an in-line continuous recording flow meter. This meter will be left in-line at the completion of the pumping test to monitor total fluid pumped from the well during periods in which the pump is in the automatic mode. Meter readings will be made at least twice a week during a three-month period subsequent to the initial pumping.

4.2 PROJECT SCHEDULE

Remcor is prepared to mobilize within two weeks of project approval. The drilling phase of this project is anticipated to require one week to

complete. The pilot pumping of the system will commence approximately three to four days after the drilling to provide time for installation of the pumping system and allow each of the wells to come to static conditions. Pumping of the recovery well will be conducted at various discharge rates over a period of one week to make a preliminary assessment of the system's operational effectiveness. The system will be operated for a period of three months, at which time the accumulated oil in nearby observation wells will again be evaluated. At this time, a decision will be made to take one of the following courses of action:

- Permit the system to continue operation as originally set up
- Modify the pumping rate and/or intake elevation in the pumping well
- Install additional recovery pumps at the six-inch monitoring wells
- Determine if product recovery is completed and discontinue pumping at the recovery well.

If product recovery appears to be complete, the pump will be shut down for a period of three months to determine whether additional oil accumulates in the recovery well. If no measurable oil accumulates in the well after this time period, the corrective measures will be considered complete.

## 4.3 AGENCY PROGRESS REPORTS

Remcor suggests that a letter of project progress will be submitted to the MDNR at the completion of the first three-month period of pumping. This letter would address the findings of the pilot pumping and notify the MDNR of Armco's selected course of action at completion of this pumping.

TABLE 1

SAMPLE ANALYSIS SUMMARY
U.S. ARMY CORPS OF ENGINEERS BLUE RIVER BANK SOIL SAMPLES

| SAMPLE IDENTIFICATION(5) | DATE | DETECTED OIL TYPE | pH (su)(6) | VOC(1) (mg/kg)(7) | PCB(2) (mg/kg) | TRPH(3) (mg/kg) | (O/G)(4) (mg/kg) |
|---|---|---|---|---|---|---|---|
| UD521 J4 | 11/12/88 | MW Oil(8) | 10.5 | NA(9) | <1 | 580 | 756 |
| UD520-IV | 11/30/88 | MW Oil | NA | <1 | <1 | 577 | 661 |
| UD520-2 | 11/30/88 | NA | NA | NA | <1 | NA | NA |
| I-520 7+ | 11/30/88 | MW Oil | 7.96 | <1 | <1 | 511 | 701 |
| I-520 9+ | 12/05/88 | MW and No. 6(10) | 7.28 | <1 | <1 | 248 | 366 |
| I-520 10+ | 12/05/88 | MW Oil | 7.54 | 12.5(11) | <1 | 827 | 996 |
| I-520 12+ | 12/05/88 | MW and No. 2(12) | 7.54 | <1 | <1 | 207 | 303 |
| I-520 13+ | 12/05/88 | MW Oil | 7.31 | <1 | <1 | 161 | 240 |
| D522-0 | 01/03/89 | No. 6 Oil | NA | NA | NA | 406 | 728 |
| D523-0 | 01/03/89 | No. 6 Oil | NA | NA | NA | 3,176 | 5,124 |
| D524-1 | 12/29/88 | No. 6 Oil | NA | NA | NA | 540 | 1,097 |
| D524-3 | 12/29/88 | No. 6 Oil*(13) | NA | NA | NA | 227 | 362 |
| D524-6 | 12/29/88 | No. 6 Oil | NA | NA | NA | 238 | 394 |
| D524-13 | 12/29/88 | No. 6 Oil* | NA | NA | NA | 84 | 178 |

See footnotes at end of table.

**TABLE 1**
(Continued)

| SAMPLE IDENTIFICATION[5] | DATE | DETECTED OIL TYPE | pH (su)[6] | VOC[1] (mg/kg)[7] | PCB[2] (mg/kg) | TRPH[3] (mg/kg) | (O/G)[4] (mg/kg) |
|---|---|---|---|---|---|---|---|
| D525-0 | 12/30/88 | No. 6 Oil* | NA | NA | NA | 1,171 | 1,716 |
| D525-3 | 12/30/88 | No. 6 Oil* | NA | NA | NA | 8,728 | 9,509 |
| D525-6 | 12/30/88 | No. 6 Oil | NA | NA | NA | 6,052 | 7,972 |
| D525-9 | 12/30/88 | No. 6 Oil | NA | NA | NA | 226 | 334 |
| D525-14 | 12/30/88 | No. 6 Oil | NA | NA | NA | 251 | 382 |
| D526-3 | 01/03/89 | No. 6 Oil | NA | NA | NA | 5,953 | 6,100 |
| D526-12 | 01/03/89 | No. 6 Oil | NA | NA | NA | 175 | 276 |
| D527-0 | 01/10/89 | No. 6 Oil | NA | NA | NA | 269 | 457 |
| D527-2 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 274 | 530 |
| D527-4 | 01/10/89 | No. 6 Oil | NA | NA | NA | 265 | 462 |
| D527-6 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 420 | 729 |
| D527-8 | 01/10/89 | No. 6 Oil* | NA | NA | NA | BDL[14] | 76 |
| D527-10 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 420 | 729 |
| D527-14 | 01/10/89 | ND | NA | NA | NA | 474 | 1,073 |
| D528-2 | 01/09/89 | No. 6 Oil* | NA | NA | NA | 321 | 573 |
| D528-5 | 01/09/89 | No. 6 Oil* | NA | NA | NA | 96 | 301 |
| D528-6 | 01/09/89 | No. 6 Oil* | NA | NA | NA | 123 | 294 |
| D528-8 | 01/09/89 | No. 6 Oil* | NA | NA | NA | 38 | 168 |

See footnotes at end of table.

**TABLE 1**
(Continued)

| SAMPLE IDENTIFICATION(5) | DATE | DETECTED OIL TYPE | pH (su)(6) | VOC(1) (mg/kg)(7) | PCB(2) (mg/kg) | TRPH(3) (mg/kg) | (O/G)(4) (mg/kg) |
|---|---|---|---|---|---|---|---|
| D529-4 | 01/10/89 | No. 6 Oil | NA | NA | NA | 138 | 452 |
| D529-6 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 347 | 864 |
| D530-2 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 546 | 1,383 |
| D530-4 | 01/10/89 | No. 6 Oil | NA | NA | NA | 484 | 1,048 |
| D530-6 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 489 | 926 |
| D530-9 | 01/10/89 | No. 6 Oil* | NA | NA | NA | 395 | 903 |

(1)"VOC" indicates volatile organic compound.

(2)"PCB" indicates polychlorinated biphenyl.

(3)"TRPH" indicates total recoverable petroleum hydrocarbon.

(4)"O/G" indicates oil and grease.

(5)Sample identification indicates boring number and sample depth.

(6)"su" indicates standard units of pH measurements.

(7)"mg/kg" indicates milligrams per kilogram.

(8)MW Oil indicates medium weight oil.

(9)"NA" indicates not analyzed.

(10)No. 6 indicates No. 6 fuel oil.

(11)"12.5" indicates source compound(s) could not be positively identified; 71 percent probability the compound is 4, 7-methano - IH - idene, 3a, 4, 7, 7a - tetrahydro (TetrahydroMethaneIndene); chloromethane detected at 133.6 micrograms per kilogram (µg/kg); xylene detected at 84 µg/kg.

(12)No. 2 indicates No. 2 fuel oil.

(13)"*" indicates weathered.

(14)"BDL" indicates below detection limits.

TABLE 2

SOIL SAMPLE RESULTS
ABOVEGROUND OIL STORAGE TANK AREA

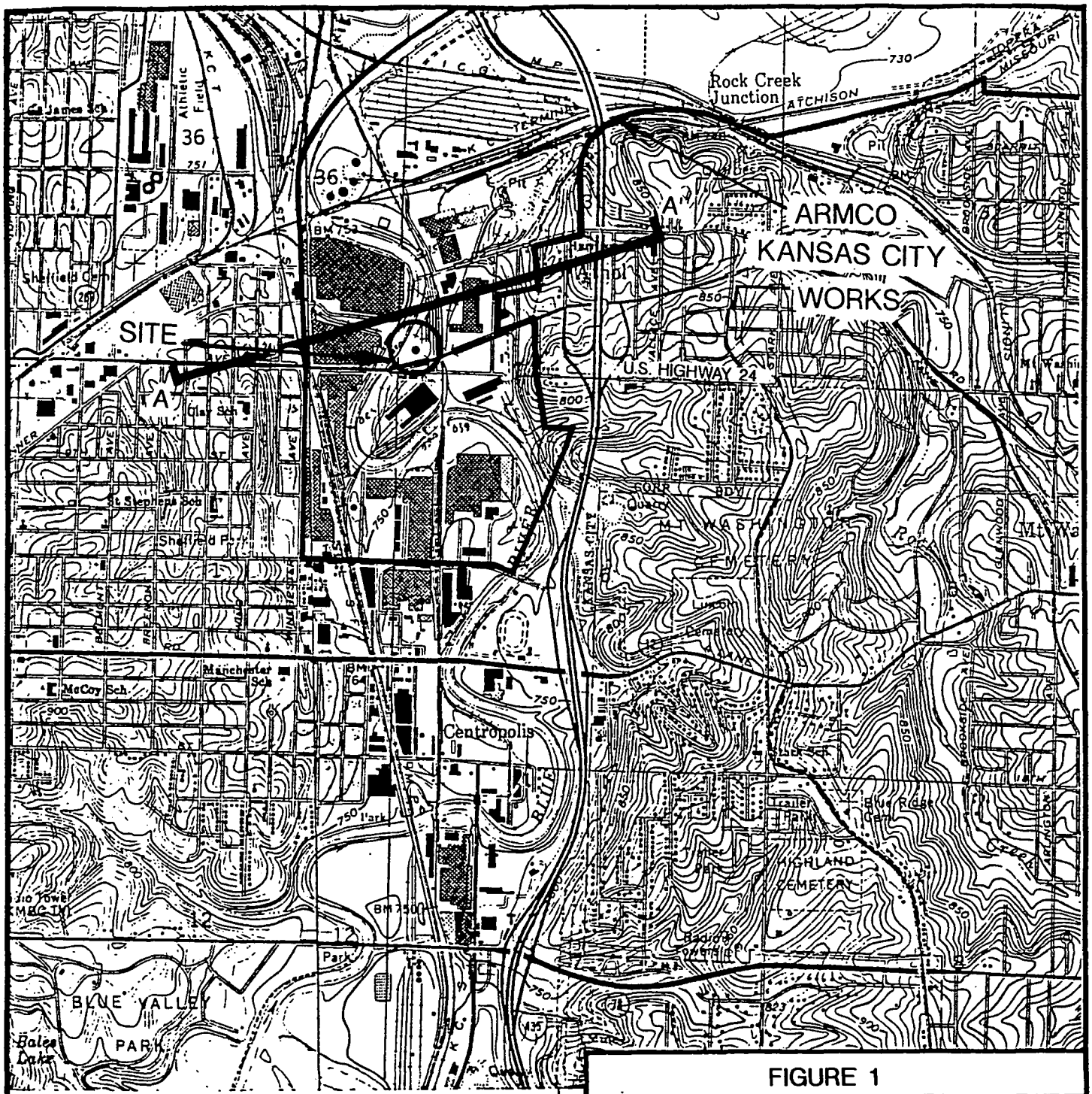
| SAMPLE NUMBER | BORING | DEPTH (feet) | MATERIAL | ABOVE WATER TABLE | AT WATER TABLE | BELOW WATER TABLE | O/G[1] (µg/g)[2] | EP TOX CHROMIUM (mg/ℓ)[3] | EP TOX LEAD (mg/ℓ) | pH SOIL (su)[4] |
|---|---|---|---|---|---|---|---|---|---|---|
| RKO-TB1A-1 | TB-1A | 0.0-0.8 | Mill scale fill | X | | | 7,700 | | | |
| RKO-TB1B-2 | TB-1B | 8.0-9.0 | Green sand fill | X | | | 63 | | | |
| RKO-TB1B-3 | TB-1B | 10.0-11.0 | Dense slag fill | | X | | 2,300 | <0.1[5] | 0.1 | 10.35 |
| RKO-TB1B-4 | TB-1B | 13.0-15.0 | Dense slag fill | | | X | 95 | | | |
| RKO-TB1B-5 | TB-1B | 18.5-19.0 | Gray silty clay | | | X | 53 | | | |
| RKO-TB2B-1 | TB-28 | 3.0-4.0 | Dense slag fill | X | | | 200 | | | |
| RKO-TB2D-2 | TB-2D | 10.0-11.0 | Dense slag fill | | | X | 100 | <0.1 | 0.4 | 9.95 |
| RKO-TB4-1 | TB-4 | 4.0-5.0 | Green sand fill | X | | | 140 | | | |
| RKO-TB5-1 | TB-5 | 4.0-5.0 | Gray silty sand | X | | | <50 | <0.1 | <0.1 | 8.35 |
| RKO-TB5-2 | TB-5 | 6.0-7.0 | Gray clayey silt | | X | | 110 | | | |
| RKO-TB5-3 | TB-5 | 11.0-12.0 | Gray silty clay | | | X | 100 | | | |
| RKO-TB6-1 | TB-6 | 0.5-1.5 | Brown silty sand | X | | | 75 | | | |
| RKO-TB6-2 | TB-6 | 5.0-6.0 | Gray sandy silt | | X | | <50 | <0.1 | 0.1 | 7.90 |
| RKO-TB6-3 | TB-6 | 7.0-8.0 | Gray sandy silt | | | X | 100/88[6] | | | |
| RKO-TB6-4 | TB-6 | 9.0-10.0 | Gray sandy silt | | | X | 480 | | | |
| RKO-TB7-1 | TB-7 | 1.0-2.0 | Brown silty sand | X | | | 77 | | | |
| RKO-TB7-2 | TB-7 | 4.0-5.0 | Brown sandy silt | | | X | 370 | <0.1 | 0.1 | 8.20 |
| RKO-TB7-3 | TB-7 | 7.0-8.0 | Gray silty sand | | | X | 78 | | | |
| RKO-TB8-1 | TB-8 | 1.0-2.0 | Scale/slag fill | X | | | 530 | | | |
| RKO-TB8-2 | TB-8 | 4.0-6.0 | Scale/slag fill | | X | | 4,000 | <0.1 | <0.1 | 7.30 |

See footnotes at end of table.

**TABLE 2**
(Continued)

| SAMPLE NUMBER | BORING | DEPTH (feet) | MATERIAL | ABOVE WATER TABLE | AT WATER TABLE | BELOW WATER TABLE | O/G[1] (µg/g)[2] | EP TOX CHROMIUM (mg/ℓ)[3] | EP TOX LEAD (mg/ℓ) | pH SOIL (su)[4] |
|---|---|---|---|---|---|---|---|---|---|---|
| RKO-TB8-3 | TB-8 | 9.0-10.0 | Gray sandy silt | | | X | <50 | | | |
| RKO-TB8-4 | TB-8 | 11.0-12.0 | Gray sandy silt | | | X | <50 | | | |
| RKO-TB9-1 | TB-9 | 1.0-2.0 | Slag/clay fill | | X | | 4,300 | <0.1 | 0.3 | 10.50 |
| RKO-TB9-2 | TB-9 | 7.0-8.0 | Gray sandy silt | | | X | <50 | | | |
| RKO-TB9-3 | TB-9 | 10.0-11.0 | Gray sandy silt | | | X | 280 | | | |
| RKO-TB10-1 | TB-10 | 1.0-2.0 | Gray sandy silt | | X | | <50 | <0.1 | <0.1 | 10.00 |
| RKO-TB10-2 | TB-10 | 3.0-4.0 | Gray sandy silt | | | X | 110 | | | |
| RKO-TB10-3 | TB-10 | 5.0-6.0 | Gray sandy silt | | | X | <50/<50 | | | |
| RKO-TB10-4 | TB-10 | 7.0-8.0 | Gray silt | | | X | <50 | | | |
| RKO-TB11-1 | TB-11A | 4.5-5.0 | Dense slag fill | X | | | 170 | | | |
| RKO-TB11-2 | TB-11B | 3.0-4.5 | Dense slag fill | X | | | 110 | | | |
| RKO-TB12-1 | TB-12 | 6.0-9.0 | Dense slag fill | X | | | 2,500 | | | |
| RKO-TP-01 | TP-1 | Surface | Oil sample | X | | | | <0.1 | <0.1 | 6.00 |

(1) O/G = oil/grease
(2) µg/g = microgram/gram
(3) mg/ℓ = milligram/liter
(4) su = standard units of pH measurement
(5) <0.1 = less than detection level
(6) #/# = sample analyzed in duplicate




REFERENCE:

USGS 7.5 MINUTE TOPOGRAPHIC
QUADRANGLES, KANSAS CITY, MO-KS
AND INDEPENDENCE, MO, 1974.
SCALE 1:24000

FIGURE 1

SITE LOCATION MAP

PREPARED FOR
ARMCO, INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | LJB 6/29/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-A2 |
| APPROVED | LMB 6/29/89 | |

REMCOR

128579

516+00
518+00
520+00
A
522+00
RECHANNELIZATION CENTER LINE
BLUE RIVER
PROPOSED PILINGS
PILINGS IN PLACE
TB-5
D-528
TB-6
D-524
D-527
TB-7
D-522
D-520
D-523
EXISTING 10" STEEL PIPE
D-525
D-530
D-529
EXISTING 12" STEEL PIPE
PILINGS IN PLACE
TP-4
TP-1
TP-2
TP-3
TB-10
D-526
TB-8
TB-9
STEEP SLOPE
PERMANENT RIGHT-OF-WAY APPROXIMATE PROPERTY LINE BETWEEN ARMCO AND CITY OF KANSAS CITY
TEMPORARY RIGHT-OF-WAY
TB-4
TB-11
TB-1
CONSTRUCTION AREA ACCESS RAMP
OIL UNLOADING PLATFORM
TB-12
TB-2
EARTHEN CONTAINMENT DIKE
PUMP HOUSE
20,000 BARREL OIL TANK
MILL SCALE STORAGE AREA (FORMER RAIL YARD)
ELEVATED PIPE LINE
U.S. RT. 24
WESTERN BORING
A'
N
50 0 50 100
scale 1"= 50' feet

LEGEND:

D-528 ▲ COE BORING LOCATION AND NUMBER

TP-1 △ SHALLOW TEST PIT AND LOCATION NUMBER

TB-8 ● SHALLOW TEST BORING WITH OIL DETECTING PIEZOMETER AND NUMBER

TB-1 ○ SHALLOW TEST BORING LOCATION AND NUMBER

A — A' CROSS SECTION LOCATION LINE

NOTE:

BORING LOCATIONS ARE APPROXIMATE, BASED UPON FIELD OBSERVATIONS.

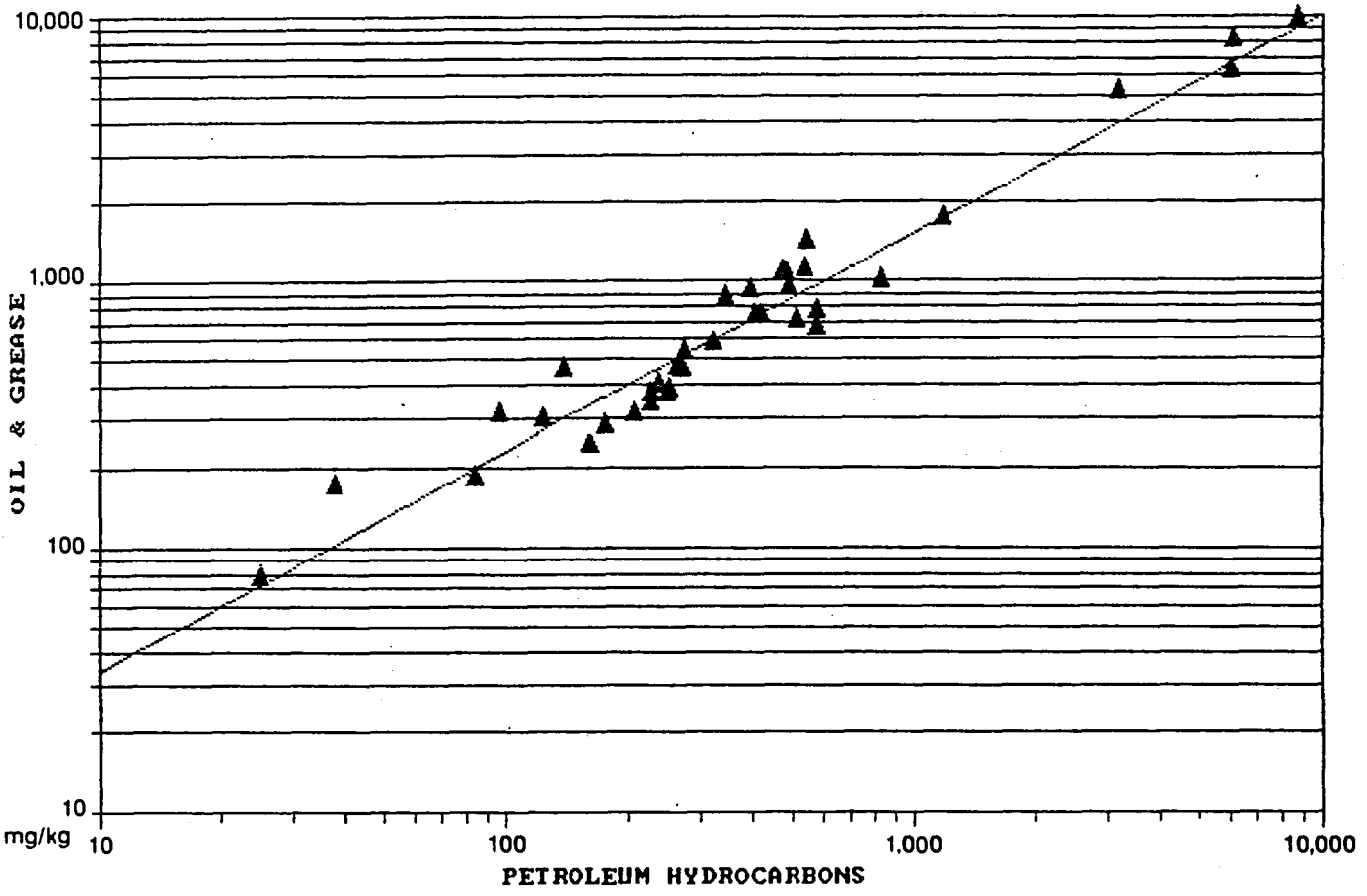
FIGURE 2

BORING LOCATION MAP

PREPARED FOR
ARMCO INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | C.E.B. 6/20/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-B5 |
| APPROVED | LMB 6/29/89 | |

REMCOR




THE REGRESSION POLYNOMIAL OF LINE 1 -

( 7.068E-01) + ( 8.246E-01)*X
THE VARIANCE - 1.048E-02

NOTE:

SAMPLES COLLECTED BY ARMY CORPS OF ENGINEERS DURING PERIOD NOVEMBER 1988 TO MARCH 1989.

FIGURE 3

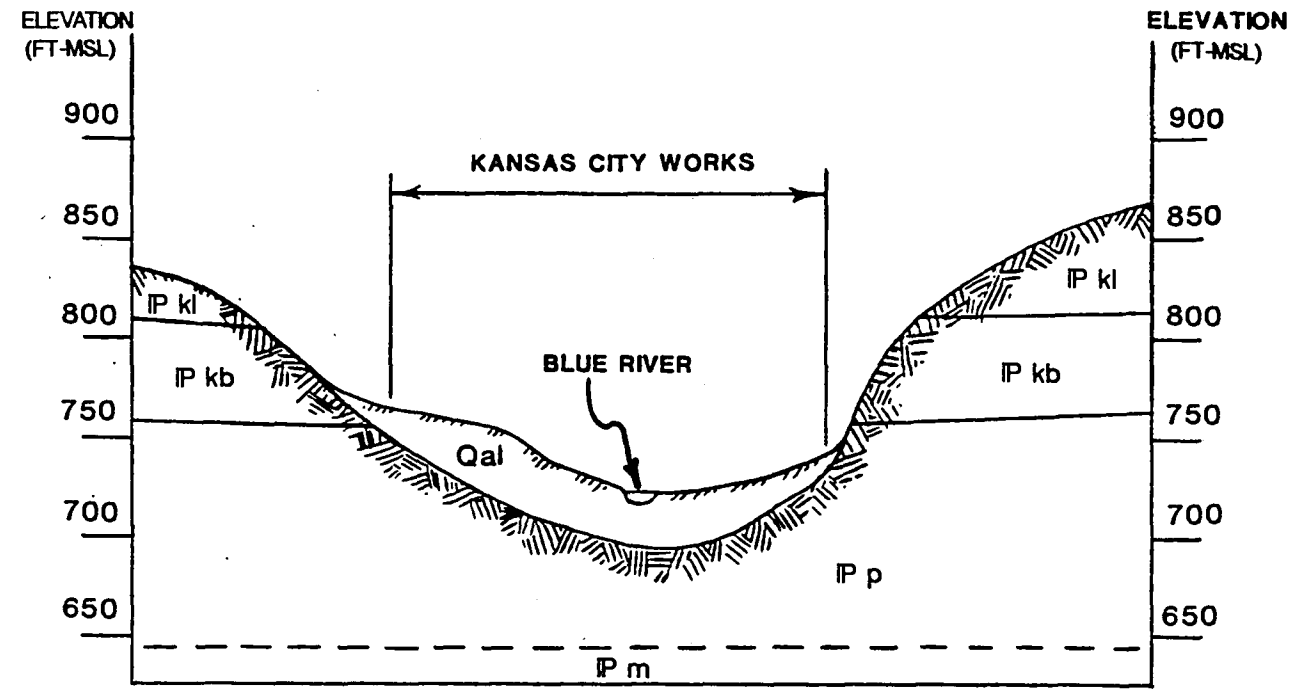
TOTAL PETROLEUM HYDROCARBON VS. OIL & GREASE RELATIONSHIP

PREPARED FOR
ARMCO INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | C.E.B. 6/20/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-A3 |
| APPROVED | LMB 6/29/89 | |

REMCOR

128570




SCALE:

HORIZ. 1" = 3000'
VERT. 1" = 100'

(VERTICAL EXAGGERATION = 30X)

LEGEND

QUATERNARY SYSTEM
- Qal - BLUE RIVER ALLUVIUM - ALLUVIAL SAND, SILT, AND GRAVEL

PENNSYLVANIAN SYSTEM
MISSOURIAN SERIES
- IPkl - KANSAS CITY GROUP, LINN SUBGROUP - PREDOMINANTLY SHALES WITH A FEW PERSISTANT LIMESTONES AND SOME THIN SANDSTONES
- IPkb - KANSAS CITY GROUP, BRONSON SUBGROUP - CYCLIC SEQUENCE OF THREE LIMESTONE FORMATIONS AND TWO SHALE-CLAY UNITS
- IPp - PLEASANTON GROUP - ARGILLACEOUS TO SANDY, MICACEOUS SHALE AND FOSSILIFEROUS SILTSTONE
- IPm - MARMATON GROUP - SHALE, LIMESTONE, SANDSTONE

REF: GEOLOGIC MAP OF INDEPENDENCE QUADRANGLE, JACKSON COUNTY, MISSOURI BY E. J. PARIZEK, 1968

FIGURE 4

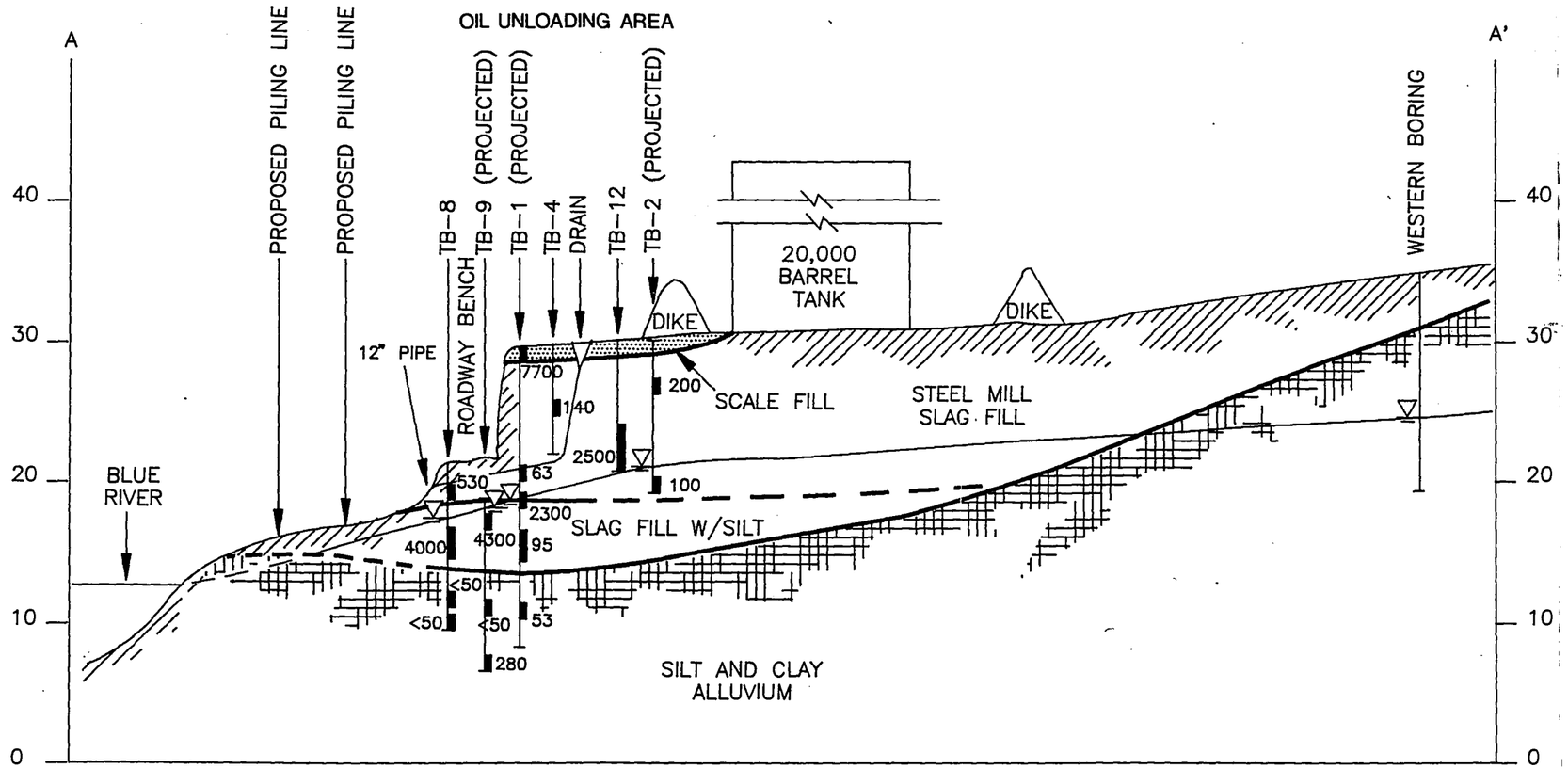
GENERALIZED GEOLOGIC CROSS SECTION

PREPARED FOR
ARMCO INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | C.E.B. 6/20/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-A4 |
| APPROVED | UMB 6/29/89 | |

REMCOR

128578




ELEVATION ABOVE ARBITRARY DATUM (FEET)

50 0 50 100
feet

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=10'
VERTICAL EXAGGERATION = 5X

LEGEND:

TB-4 = BORING NUMBER

200 = SAMPLE LOCATION AND OIL/GREASE CONCENTRATION

= GROUND WATER

= DEPTH OF BORING

NOTES:

1: SEE FIGURE 1 FOR CROSS SECTION LOCATION.
2: TOPOGRAPHY IS APPROXIMATE, BASED ON FIELD OBSERVATIONS AND U.S. ARMY CORPS OF ENGINEERS RECHANNELIZATION DESIGN DRAWINGS.
3: ELEVATION OF BLUE RIVER STAGE IS APPROXIMATE.

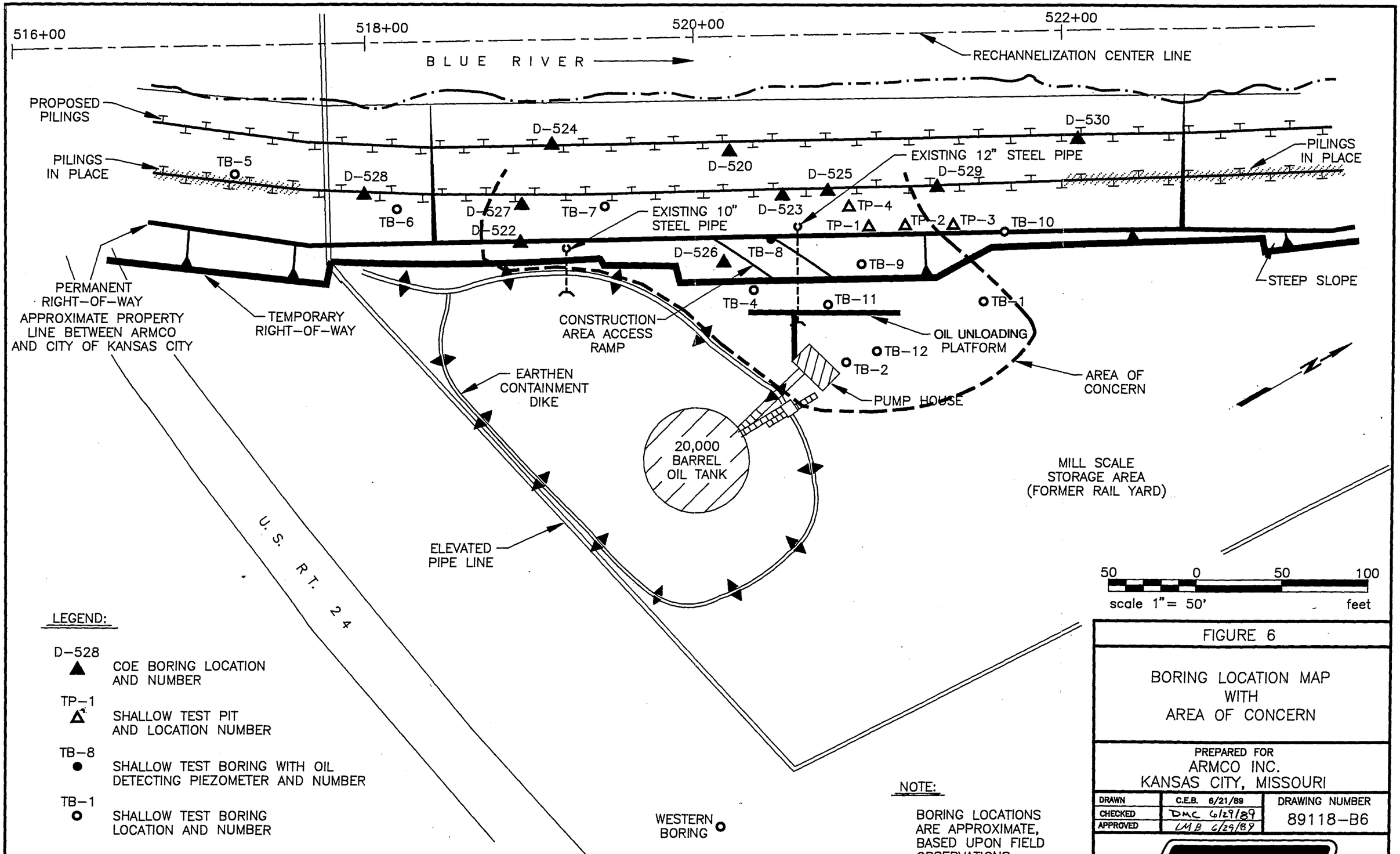
FIGURE 5

GEOLOGIC CROSS-SECTION A-A'

PREPARED FOR
ARMCO INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | L.B.L. 6/21/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-B8 |
| APPROVED | LMB 6/29/89 | |

REMCOR




LEGEND:

- D-528 ▲ — COE BORING LOCATION AND NUMBER
- TP-1 △ — SHALLOW TEST PIT AND LOCATION NUMBER
- TB-8 ● — SHALLOW TEST BORING WITH OIL DETECTING PIEZOMETER AND NUMBER
- TB-1 o — SHALLOW TEST BORING LOCATION AND NUMBER

NOTE:

BORING LOCATIONS ARE APPROXIMATE, BASED UPON FIELD OBSERVATIONS.

FIGURE 6

BORING LOCATION MAP
WITH
AREA OF CONCERN

PREPARED FOR
ARMCO INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | C.E.B. 6/21/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-B6 |
| APPROVED | LMB 6/29/89 | |

REMCOR

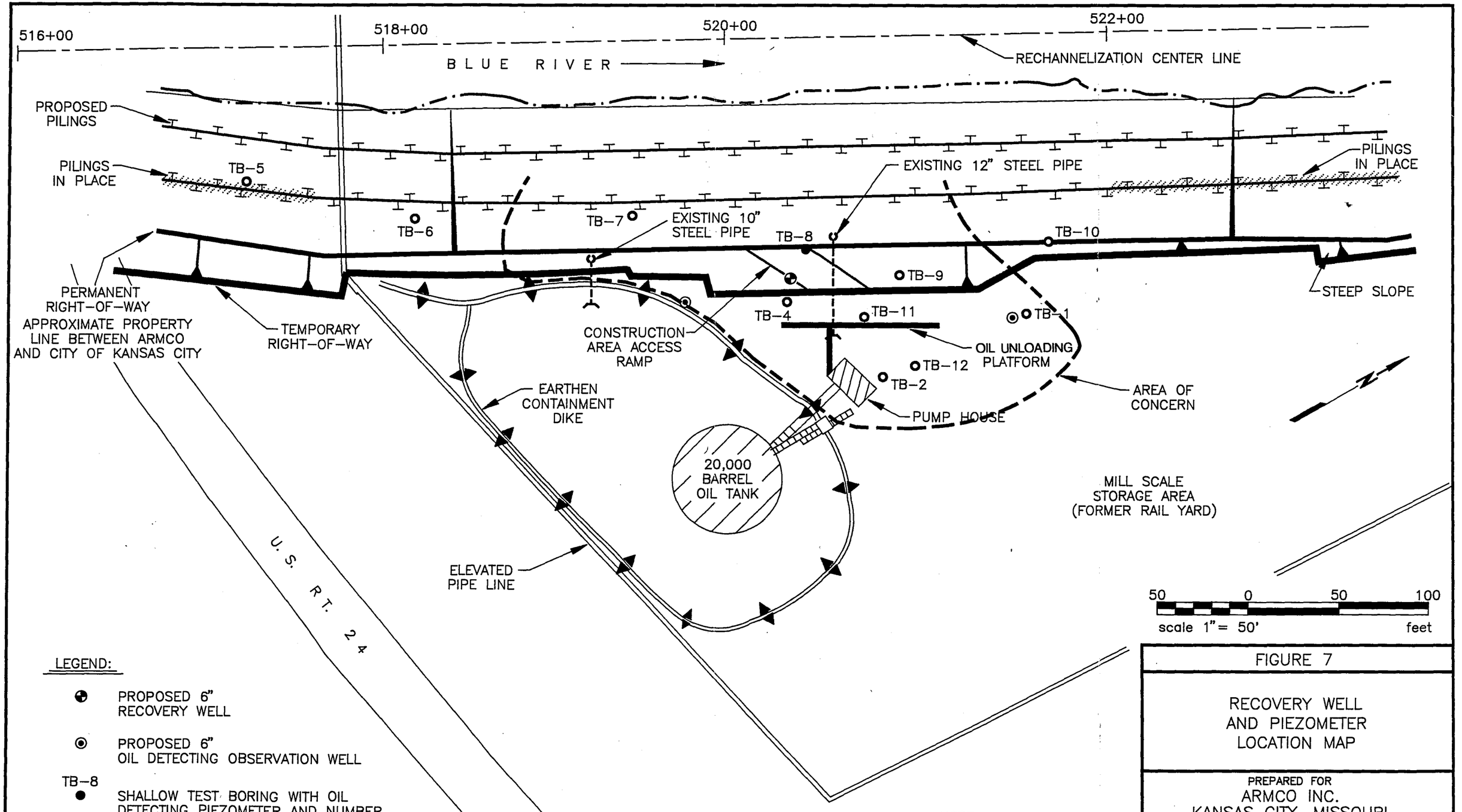



FIGURE 7

RECOVERY WELL AND PIEZOMETER LOCATION MAP

PREPARED FOR
ARMCO INC.
KANSAS CITY, MISSOURI

| | | |
|---|---|---|
| DRAWN | C.E.B. 6/21/89 | DRAWING NUMBER |
| CHECKED | DMC 6/29/89 | 89118-B7 |
| APPROVED | LMP 6/29/89 | |

REMCOR

## LIST OF REFERENCES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APPENDIX A

U.S. ARMY CORPS OF ENGINEERS LABORATORY
REPORT FOR ORGANICS;
SAMPLE I-520, 10.5' TO 12.0'

C21

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: BLUE RIVER CHANNEL - DR. JOE SOLSKY

WORK ORDER NO.: 240 PROJECT NO.: 10211

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for B/N/A

EXTRACTED: 12-12-88 ANALYZED: 12-13-88

ANALYST: L. Davidson, Ph.D. LAB NOTEBOOK NO.: 90, Pg. 98

CUSTOMER SAMPLE NO.: I-520,10.5'-12.0' (881206-003) EHRT NO.: 15511

---

RESULTS (mg/kg)

---

2-Picoline - BDL

Ethyl Methanesulfonate - BDL

Benzyl Alcohol - BDL

1,3-Dichlorobenzene - BDL

1,2-Dichlorobenzene - BDL

N-Nitrosodimethylamine - BDL

Acetophenone - BDL

Nitrobenzene - BDL

Bis(2-Chloroethoxy)Methane - BDL*

a-,a-Dimethylphenethylamine - BDL

Naphthalene - 12.88

N-Nitroso-di-n-butylamine - BDL

Hexachlorocyclopentadiene - BDL

1-Chloronaphthalene - BDL

Dimethylphthalate - BDL

Acenaphthene - 1.14

1,2,4,5-Tetrachlorobenzene - BDL

4-Nitroaniline - BDL

4-Chloroaniline - BDL

Methyl Methanesulfonate - BDL

Aniline - BDL

Bis(2-Chloroethyl)Ether - BDL

1,4-Dichlorobenzene - BDL

Bis(2-Chloroisopropyl)Ether - BDL

N(Nitrosodi-N-Propylamine) - BDL

Hexachloroethane - BDL

Isophorone - BDL*

Benzoic Acid - 50.75

1,2,4-Trichlorobenzene - BDL

Hexachlorobutadiene - BDL

2-Methylnaphthalene - 17.53

2-Chloronaphthalene - BDL*

2-Nitroaniline - BDL

Acenaphthylene - BDL*

Pentachloronitrobenzene - BDL

3-Nitroaniline - BDL

2,4-Dinitrotoluene - BDL

Endrin Ketone - BDL

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: BLUE RIVER CHANNEL - DR. JOE SOLSKY

WORK ORDER NO.: 240 PROJECT NO.: 10211

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for B/N/A

EXTRACTED: 12-12-88 ANALYZED: 12-13-88

ANALYST: L. Davidson, Ph.D. LAB NOTEBOOK NO.: 90, Pg. 98

CUSTOMER SAMPLE NO.: I-520,10.5'-12.0' (881206-003) EHRT NO.: 15511

RESULTS (mg/kg)

2,6-Dinitrotoluene - BDL

Diethylphthalate - BDL

2-Naphthylamine - BDL

Fluorene - 0.68

Diphenylamine - BDL

N-Nitrosopiperidine - BDL

4-Aminobiphenyl - BDL

Pentachlorobenzene - BDL

Pronamide - BDL

Anthracene - BDL*

Beta-BHC - BDL

Delta-BHC - BDL

Aldrin - BDL

Heptachlor Epoxide - BDL

Fluoranthene - BDL

4,4'-DDE - BDL

Pyrene - BDL*

Endosulfan II - BDL

Dibenzofuran - BDL*

1-Naphthylamine - BDL

4-Chlorophenyl-Phenyl-Ether - BDL

N-Nitrosodiphenylamine - BDL

1,2-Diphenylhydrazine - BDL

4-Bromophenyl-Phenyl-Ether - BDL

Hexachlorobenzene - BDL

Phenacetin - BDL

Phenanthrene - 3.94

Alpha-BHC - BDL

Gamma-BHC (Lindane) - BDL

Heptachlor - BDL

Di-n-Butylphthalate - BDL

Endosulfan I - BDL

Dieldrin - BDL

Benzidine -BDL

Endrin - BDL

4,4'-DDD - BDL

C2

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: BLUE RIVER CHANNEL - DR. JOE SOLSKY

WORK ORDER NO.: 240 PROJECT NO.: 10211

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for B/N/A

EXTRACTED: 12-12-88 ANALYZED: 12-13-88

ANALYST: L. Davidson, Ph.D. LAB NOTEBOOK NO.: 90, Pg. 98

CUSTOMER SAMPLE NO.: I-520, 10.5'-12.0' (881206-003) EHRT NO.: 15511

---

RESULTS (mg/kg)

---

| | |
|---|---|
| p-Dimethylaminoazobenzene - BDL | Butyl-Benzyl-Phthalate - BDL |
| 3,3'-Dichlorobenzidine - BDL | Benzo(a)Anthracene - BDL |
| Bis(2-Ethyl-Hexyl)Phthalate - BDL | Chrysene - BDL |
| 7,12-Dimethylbenz(a)anthracene - BDL | 4,4'-DDD - BDL |
| Endosulfan Sulfate - BDL | Endrin Aldehyde - BDL |
| 3-Methylcholanthrene - BDL | Di-n-Octylphthalate - BDL |
| Benzo(b)Fluoranthene - BDL | Benzo(k)Fluoranthene - BDL |
| Benzo(a)Pyrene - BDL | Dibenz(a,j)Acridine - BDL |
| Indeno(1,2,3-c,d)Pyrene - BDL | Dibenzo(a,h)Anthracene - BDL |
| Benzo(g,h,i)Perylene - BDL | |

---

*BDL - Compound detected in trace amount, too low to be accurately measured.

COMPUTER SEARCH:

1-Methylnaphthalene = Approximately 14.90 mg/kg

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: BLUE RIVER CHANNEL - DR. JOE SOLSKY

WORK ORDER NO.: 240 PROJECT NO.: 10211

SAMPLE TYPE: SOIL SAMPLE METHOD NO.: EPA 8270

ANALYSIS PERFORMED: GC/MS Analysis for Acids

EXTRACTED: 12-12-88 ANALYZED: 12-13-88

ANALYST: L. Davidson, Ph.D. LAB NOTEBOOK NO.: 90, Pg. 98

CUSTOMER SAMPLE NO.: I-520, 10.5'-12.0' (881206-003) EHRT NO.: 15511

RESULTS (mg/kg)

| | |
|---|---|
| Phenol - BDL | 2-Chlorophenol - BDL |
| 2-Methylphenol - BDL | 4-Methylphenol - BDL |
| 2-Nitrophenol - BDL | 2,4-Dimethylphenol - BDL |
| 2,4-Dichlorophenol - BDL | 2,6-Dichlorophenol - BDL |
| 4-Chloro-3-Methyl Phenol - BDL | 2,4,6-Trichlorophenol - BDL |
| 2,4,5-Trichlorophenol - BDL | 2,4-Dinitrophenol - BDL |
| 4-Nitrophenol - BDL | 2,3,4,6-Tetrachlorophenol - BDL |
| 4,6-Dinitro-2-Methyl Phenol - BDL | Pentachlorophenol - BDL |

| SURROGATE COMPOUND | PERCENT RECOVERY |
|---|---|
| Nitrobenzene-$d_5$ | 93.22% |
| 2-Fluorobiphenyl | 113.67% |
| Terphenyl-$d_{14}$ | 81.46% |
| Phenol-$d_6$ | 83.82% |
| 2-Fluorophenol | 69.75% |
| 2,4,6-Tribromophenol | 37.43% |

QUALITY CONTROL OFFICER: [signature]

DATE: 12/13/88

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: BLUE RIVER CHANNEL - DR. JOE SOLSKY

WORK ORDER NO.: 240 PROJECT NO.: 10211

SAMPLE TYPE: SOIL SAMPLE DATE ANALYZED: 12-12-88

ANALYSIS PERFORMED: Volatile Organics Analysis METHOD NO.: EPA 8240

ANALYST: J. Tobler LAB NOTEBOOK NO.: 98, Pg. 11

CUSTOMER SAMPLE NO.: I-520, 10.5'-12.0' (881206-003) EHRT NO.: 15511

RESULTS (ug/kg)

| | |
|---|---|
| Chloromethane - 133.6 | Bromomethane - BDL |
| Vinyl Chloride - BDL | Chloroethane - BDL |
| Methylene Chloride - BDL | Trichlorofluoromethane - BDL |
| 1,1-Dichloroethylene - BDL | 1,1-Dichloroethane - BDL |
| 1,2-Dichloroethylene - BDL | Chloroform - BDL |
| 1,2-Dichloroethane - BDL | 1,1,1-Trichloroethane - BDL |
| Carbontetrachloride - BDL | Bromodichloromethane - BDL |
| 1,2-Dichloropropane - BDL | Trans-1,3-Dichloropropene - BDL |
| Trichloroethylene - BDL | Cis-1,3-Dichloropropene - BDL |
| Benzene - BDL | Chlorodibromomethane - BDL |
| 1,1,2-Trichloroethane - BDL | 2-Chloroethylvinylether - BDL |
| Bromoform - BDL | 1,1,2,2-Tetrachloroethane - BDL |
| Tetrachloroethylene - BDL | Toluene - BDL |
| Chlorobenzene - BDL | Ethylbenzene - BDL |

SURROGATE STANDARDS - % RECOVERIES

1,2-Dichloroethane-$d_4$ - 81.1%
Toluene-$d_8$ - 54.4%
Bromofluorobenzene - 55.4%

C2

ENVIRONMENTAL HEALTH RESEARCH AND TESTING, INC.
RESULT SHEET

CUSTOMER NAME: U.S. ARMY CORPS OF ENGINEERS

SAMPLE SOURCE: BLUE RIVER CHANNEL - DR. JOE SOLSKY

WORK ORDER NO.: 240 PROJECT NO.: 10211

SAMPLE TYPE: SOIL SAMPLE DATE ANALYZED: 12-12-88

ANALYSIS PERFORMED: Volatile Organics Analysis METHOD NO.: EPA 8240

ANALYST: J. Tobler LAB NOTEBOOK NO.: 98, Pg. 11

CUSTOMER SAMPLE NO.: I-520,10.5'-12.0' (881206-003) EHRT NO: 15511

---

RESULTS (ug/kg)

---

| | |
|---|---|
| Acetone - BDL | Acrolein - BDL |
| Acrylonitrile - BDL | 2-Butanone - BDL |
| Carbon Disulfide - BDL | Dibromomethane - BDL |
| 1,4-Dichloro-2-Butene - BDL | Dichlorodifluoromethane - BDL |
| Ethanol - BDL | Ethylmethacrylate - BDL |
| 2-Hexanone - BDL | Iodomethane - BDL |
| 4-Methyl-2-Pentanone - BDL | Styrene - BDL |
| 1,2,3-Trichloropropane - BDL | Vinyl Acetate - BDL |

Xylene - 84

---

COMPUTER SEARCH:

TetrahydroMethaneIndene = Approximately 12,000 ug/kg

DETECTION LIMIT: RAISED BY FACTOR OF 2.5

QUALITY CONTROL OFFICER: [signature]

DATE: 12/13/88

APPENDIX B

BORING LOGS

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO Kewanee Oil TANK | | |
| BORING NUMBER: TB-1 | COORDINATES: | DATE: 5/5/89 | |
| ELEVATION: | GWL: Depth Date/Time | DATE STARTED: 5/1/89 | |
| ENGINEER/GEOLOGIST: D. Crowley | Depth Date/Time | DATE COMPLETED: 5/1/89 | |
| DRILLING METHODS: Hollow Stem Auger | | PAGE 1 OF 1 | |

| DEPTH (Ft.) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER 1 Foot | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 166 | 70 | LOOSE BLACK FINE MILL SCALE FILL<br>VERY DENSE TAN/BROWN SLAG GRAVEL FILL; DRY | | | RKO-TB1A-1<br>←AUGER REFUSAL @ TB1A |
| | S/2 | 236 | 50 | | | | |
| 5 | | | | | | | |
| | S/3 | 46 | 80 | (LOOSE) GREEN COARSE SAND FILL DAMP, RESEMBLES OLIVINE | | | RKO-TB1B-2 |
| 10 | S/4 | 42 | 50 | DENSE BROWN FILL; SLAG TRACE MILL SCALE AND WEATHERED FIRE BRICK, WET | | | WATER @ 10.5<br>RKO-TB1B-3<br>SLIGHT PHC ODOR |
| | S/5 | 75 | 0 | | | | |
| | S/6 | 40 | 50 | | | | SLIGHT PHC ODOR<br>RKO-TB1B-4 |
| 15 | S/7 | 6 | 25 | SOFT DARK GRAY TO BLACK SILTY CLAY; some PLANT FRAGMENTS, DAMP | CL | | slight PHC odor |
| | S/8 | 5 | NR | | | | RKO-TB1B-5 |
| 20 | S/9 | 6 | 0 | | | | |
| | | | | ↖Bottom of Boring 21.0' | | | |

NOTES:

NR - indicates not recorded

This boring log reflects conditions encounter at Test Boring TB1A AND TB-1B AS A single boring; TB-1.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 8911 8 | PROJECT NAME: ARMCO KC Works Oil Tank | | |
| BORING NUMBER: TB-2 | COORDINATES: | | DATE 5/9/89 |
| ELEVATION: | GWL: Depth | Date/Time | DATE STARTED 5/2/89 |
| ENGINEER/GEOLOGIST: D. Crowley | Depth | Date/Time | DATE COMPLETED 5/2/89 |
| DRILLING METHODS: Hollow Stem Auger | | | PAGE 1 OF 1 |

| DEPTH (Ft.) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER (Foot) | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 136 | 50 | DENSE BLACK FINE MILLSCALE FILL | | | - TRACE OIL SHEEN |
| | | | | VERY DENSE TAN BROWN FILL; | | | - AUGER REFUSAL @ TB2A |
| | S/2 | 133 | 65 | SLAG AND GRAVEL, DRY | | | - TRACE OIL SHEEN |
| | | | | | | | - RKO-TB2B-1 |
| 5 | | | | | | | - AUGER REFUSAL @ TB2B |
| | | | | | | | - AUGER REFUSAL @ TB2C |
| | | | | | | | ← WATER @ 9.0' |
| | | | | | | | - NO OIL SHEEN |
| 10 | S/3 | 170 | 40 | DARK BROWN SLAG, TRACE SCALE, MOIST | | | - RKO-TB2D-02 |
| | | | | ↖ Total Depth of Boring 11.0' | | | |
| 15 | | | | | | | |

NOTES:

This boring log reflects conditions encountered at test borings TB2A, TB2B, TB2C, and TB2D as a single Boring; TB-2

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO KC Works Oil Tank | | |
| BORING NUMBER: TB-3 | COORDINATES: | DATE: 5/9/89 | |
| ELEVATION: | GWL: Depth Date:Time | DATE STARTED: 5/2/89 | |
| ENGINEER/GEOLOGIST: D. Crowley | Depth Date:Time | DATE COMPLETED: 5/2/89 | |
| DRILLING METHODS: Hollow Stem Augers | | PAGE 1 OF 1 | |

| DEPTH (FT) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER 6 inch | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 31 | 50 | DENSE GRAY FILL; LIMESTONE GRAVEL AND SLAG, DRY | | | PHC ODOR<br>RKO-TB3-1 |
| | S/2 | 13 | 75 | STIFF DARK GRAY SILTY CLAY; DAMP TO WET, PLANT FRAGMENTS, some Mottling Associated with Decaying PLANT MATTER | CL | | PHC ODOR |
| 5 | S/3 | 20 | 50 | | | | RKO-TB3-2 |
| | S/4 | 12 | | | | | |
| 10 | S/5 | 7 | 100 | MEDIUM STIFF CLAYEY SILT; TRACE TO SOME SAND, WET | ML | | WATER @ 10.5 WITH PHC ODOR<br>RKO-TB3-3 |
| 15 | | | | Total Depth of Boring 15.0' | | | |

NOTES:

WATER LEVEL MEASURED 3 DAYS AFTER DRILLING SHOWED NO FLOATING PRODUCT.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO K2 Works Oil Tank | | |
| BORING NUMBER: TB-4 | COORDINATES: | DATE: 5/12/89 | |
| ELEVATION: | GWL: Depth Date/Time | DATE STARTED: 5/2/89 | |
| ENGINEER/GEOLOGIST: D. Crowley | Depth Date/Time | DATE COMPLETED: 5/2/89 | |
| DRILLING METHODS: Hollow Stem Auger | | PAGE 1 OF 1 | |

| DEPTH (FT) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER 1 Foot | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 90 | 45 | VERY DENSE BLACK TAN FILL SLAG AND MILL SCALE, TRY TO RAMP | | | |
| | S/2 | 28 | 60 | (LOOSE) GREEN SAND FILL; RESEMBLES ALLUVIUM | | | RKO-TB4-01 |
| 5 | S/3 | 96 | 30 | VERY DENSE DARK GRAY FILL; SLAG | | | -Auger Refusal |
| | | | | ↑Bottom of Boring 7.5' | | | |
| 10 | | | | | | | |

NOTES:
Boring TB-4B encountered refusal @ 3'.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 8911 8 | PROJECT NAME: ARMCO. KC Works Oil TANK | | |
| BORING NUMBER: TB-5 | COORDINATES: | DATE: 5/12/89 | |
| ELEVATION: | GWL: Depth / Date, Time | DATE STARTED 5/2/89 | |
| ENGINEER/GEOLOGIST: D. Crowley | Depth / Date, Time | DATE COMPLETED 5/2/89 | |
| DRILLING METHODS: Hollow Stem Auger | | PAGE 1 OF 1 | |

| DEPTH (FT) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER (Foot) | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 4 | 50 | LOOSE GRAY SILTY FINE SAND; SOME CLAY, PLANT FRAGMENTS DAMP | SM/ML | | NO PHC ODOR |
| | S/2 | 4 | 50 | | | | RKO-TB5-1 |
| 5 | S/3 | 2 | 6 | SOFT GRAY CLAYEY SILT; TRACE TO SOME SAND, WET, PLANT FRAGMENTS | ML | | WATER @ 6.0' RKO-TB5-2 |
| | S/4 | 4 | 60 | MEDIUM STIFF GRAY SILTY CLAY DAMP | CL | | |
| | | | | SOFT GRAY SILT; WET | ML | | |
| 10 | S/5 | 4 | 100 | SOFT MOTTLED GRAY SILTY CLAY; INTERBEDDED SOFT LIGHT GRAY SILTY SAND; LAMINATED, WET | CL/SM | | RKO-TB5-3 |
| | | | | ↖ Bottom of Boring @ 12.0' | | | |

NOTES:

Water level rose to G. Surface with very light oil sheen two days later.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO KC Works Oil Tank | | |
| BORING NUMBER: TB-6 | COORDINATES: | | DATE: |
| ELEVATION: | GWL: Depth | Date/Time | DATE STARTED: |
| ENGINEER/GEOLOGIST: D. Crowley | Depth | Date/Time | DATE COMPLETED: |
| DRILLING METHODS: Continuous Split Spoon Sampling | | | PAGE 1 OF 1 |

| DEPTH (FT.) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER 1FT. | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S-1 | 1 | | LOOSE BROWN SILTY FINE SAND; MOIST, PLANT FRAGMENTS | SM | | RKO-TB6-1 |
| | S-2 | 2 | | SOFT LIGHT to Medium GRAY (FINE) SANDY SILT; TRACE TO SOME CLAY, MOIST TO WET, PLANT FRAGMENTS WITH BLACK STAINS Resulting from Decay | ML | | Water @ 5.0' |
| 5 | S-3 | 4 | 80 | | | | RKO-TB6-2 |
| | S-4 | 4 | 100 | | | | RKO-TB6-3 |
| | S-5 | 5 | 100 | | | | RKO-TB6-4 |
| 10 | | | | ↑Bottom of Boring @ 10.0' | | | |

NOTES:

NO EVIDENCE of PAC stains, sheens or odors during drilling. Backfilled hole w/ bentonite pellets.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: | PROJECT NAME: | | |
| BORING NUMBER: TB-7 | COORDINATES: | | DATE: 5/16/89 |
| ELEVATION: | GWL: Depth 1.3 | Date/Time 5/4/89 | DATE STARTED: 5/16/89 |
| ENGINEER/GEOLOGIST: | Depth | Date/Time | DATE COMPLETED: 5/16/89 |
| DRILLING METHODS: Solid Auger & Geoprobe | | | PAGE OF |

| DEPTH (ft) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER (6 in.) | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | LOOSE GRAY FILL; GRAVEL AND WOOD | | | |
| | | 12 | 20 | LOOSE GRAY/BROWN SILTY FINE SAND; WET, BANDS OF SILT INCREASE WITH DEPTH. | SM/ML | | RKO-TB7-1 ← STRONG PHC ODOR |
| | | ? | | | | | ← WATER @ 3.0' NOTICABLE PHC SHEEN |
| 5 | | 4 | 80 | SOFT GRAY/BROWN (FINE) SANDY SILT; TRACE TO SOME CLAY, WET, PLANT FRAGMENTS | ML | | RKO-TB7-2 ← LACK OF PHC ODOR BELOW 5.0' |
| | | | | SOFT GRAY SILTY CLAY; DAMP | CL | | |
| | | 10 | 60 | LOOSE LIGHT GRAY SILTY FINE SAND; MOIST, LAMINATED. | SM/ML | | RKO-TB7-3 |
| | | | | Bottom of Boring @ 8.0' | | | |
| 10 | | | | | | | |

NOTES:

Water observed 5/4/89 showed some light oil (Resembles Kerosene) floating on W. Level. Oil Thickness too thin to be measured.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 8911 8 | PROJECT NAME: ARMCO KC Works Oil TANK | | |
| BORING NUMBER: TB-8 | COORDINATES: | DATE: 5/18/89 | |
| ELEVATION: | GWL: Depth / Date:Time | DATE STARTED: 5/3/89 | |
| ENGINEER/GEOLOGIST: D. Crowley | Depth / Date:Time | DATE COMPLETED: 5/3/89 | |
| DRILLING METHODS: Hollow Stem Auger | | PAGE 1 OF 1 | |

| DEPTH (Ft) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER (Foot) | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 25 | 50 | Loose to Dense BROWN Scale and slag FILL | | | RKO-TB8-1 |
| | S/2 | 6 | 30 | | | | ← Heavy Black Oil @ 3.9' |
| 5 | S/3 | 11 | 30 | -Oil SATURATED FILL<br>-FILL WET | | | RKO-TB8-2 |
| | S/4 | 36 | 30 | | | | STRONG PHC ODOR |
| | S/5 | 7 | 100 | SOFT TO MEDIUM DENSE DARK GRAY SANDY SILT ; TRACE CLAY, WET SOME PLANT FRAGMENTS | ML | | RKO-TB8-3 |
| 10 | S/6 | 9 | 100 | | | | RKO-TB8-4 |
| | | | | ← Bottom of Boring @ 12.0' | | | |

NOTES:

Installed piezometer in boring to determine whether product was floating on aquifer. See Piezometer installation diagram for special construction.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | |
|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO KC Works Oil TANK | |
| BORING NUMBER: TB-9 | COORDINATES: | DATE: 5/18/89 |
| ELEVATION: | GWL: Depth 0.08 Date/Time 5/4/89 0900 | DATE STARTED: 5/3/89 |
| ENGINEER/GEOLOGIST: D. Crowley | Depth Date/Time | DATE COMPLETED: 5/3/89 |
| DRILLING METHODS: Hollow Stem Augers | | PAGE 1 OF 1 |

| DEPTH (Ft) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER 1 Foot | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 20 | 40 | Dense to Very Dense GRAY/TAN FILL; Gray silty clay wet/oil | | | ← WATER / OIL<br>RKO-TB9-1 |
| | S/2 | 39 | 30 | - GRAY SILT AND GRAVEL<br>- Rocky difficult to Auger | | | ← APPEARENT Bottom of OILY ZONE |
| 5 | | | | | | | |
| | S/3 | 5 | 60 | Medium Stiff Dark Gray Mottled (Fine) SANDY silt; wet, plant fragments, PHC ODOR | ML/SM | | RKO-TB9-2 |
| | S/4 | 9 | 30 | | | | |
| 10 | S/5 | 4 | | - Trace Gravel | | | RKO-TB9-3 |
| | | | | ↑ Bottom of Boring @ 12.0' | | | |

NOTES:

Water level @ ground surface with floating oil too thin to measure.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 8918 | PROJECT NAME: ARMCO KC Works Oil Tank | | |
| BORING NUMBER: TB 10 | COORDINATES: | | DATE: 5/18/89 |
| ELEVATION: | GWL: Depth 1.0 Date:Time 5/4/89 0930 | | DATE STARTED: 5/4/89 |
| ENGINEER/GEOLOGIST: D. Crowley | Depth | Date:Time | DATE COMPLETED: 5/4/89 |
| DRILLING METHODS: Hollow Stem Auger | | | PAGE 1 OF 1 |

| DEPTH (FT) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER 1 FOOT | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | S/1 | 3 | 80 | SOFT BROWN SILTY CLAY; TRACE SAND MOIST | | | WATER @ 2.0' |
| | S/2 | 3 | 80 | SOFT GRAY-DARKGRAY (FINE) SANDY SILT; SOME CLAY, WET | ML/SM | | RKO-TB10-1 NO NOTICABLE PHC SHEEN OR ODOR RKO-TB10-2 |
| 5 | S/3 | 5 | | -SILT AND SAND INTERBEDDED -DARK GRAY TO BLACK AND ORGANIC RICH | | | RKO-TB10-3 |
| | S/4 | 5 | | MEDIUM STIFF LIGHT GRAY SILT; SOME CLAY | ML | | RKO-TB10-4 |
| | | | | Bottom of Hole @ 8.0' | | | |
| 10 | | | | | | | |

NOTES:

Water level of 1.0' observed but no sheen or floating oil.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | |
|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: REMCO KCWorks O.I. TANK | |
| BORING NUMBER: TB-11 | COORDINATES: | DATE: 5/18/89 |
| ELEVATION: | GWL: Depth Date:Time | DATE STARTED: 5/4/89 |
| ENGINEER/GEOLOGIST: D Crowley | Depth Date:Time | DATE COMPLETED: 5/4/89 |
| DRILLING METHODS: Hollow Stem Augers | | PAGE 1 OF 1 |

| DEPTH (Ft) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER (Foot) | RECOVERY % (ft) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | VERY DENSE BROWN FILL; DAMP SLAG AND SAND | | | no noticable PHC odor |
| | | | | | | | RKO-TB11-2 (TB11B) |
| | | | | | | | AUGER REFUSAL @ TB11B |
| | S/1 | 176 | | | | | RKO-TB11-1 (TB11A) |
| | | | | Bottom of Boring @ 5.5' | | | AUGER REFUSAL @ TB11A |

NOTES:

Boring log reflects conditions encountered @ Test Borings TB-11A and TB11B (located 8' apart) as a single Boring TB-11.

REMCOR

# VISUAL CLASSIFICATION OF SOILS

| | | | |
|---|---|---|---|
| PROJECT NUMBER: 8911 8 | PROJECT NAME: ARMCO KC Works O-1 TANK | | |
| BORING NUMBER: TB-12 | COORDINATES: | DATE: 5/18/89 | |
| ELEVATION: | GWL: Depth / Date/Time | DATE STARTED: 5/4/89 | |
| ENGINEER/GEOLOGIST: D. Crowley | Depth / Date/Time | DATE COMPLETED: 5/4/89 | |
| DRILLING METHODS: Hollow Stem Augers | | PAGE 1 OF 1 | |

| DEPTH (Ft.) | SAMPLE TYPE & NO. | BLOWS ON SAMPLER PER (1 Foot) | RECOVERY (%) | DESCRIPTION | USCS SYMBOL | MEASURED CONSISTENCY (TSF) | REMARKS |
|---|---|---|---|---|---|---|---|
| 5 | | | | Very Dense, Gray Fill; Dry Slag -unable to split spoon. | | | -AUGER REFUSAL @ TB12B<br>-AUGER REFUSAL @ TB12A<br>-RKO-TB12-1 (collected from Augers) |
| 10 | | | | ← Bottom of Boring | | | AUGER REFUSAL @ TB-12C |

NOTES:

Boring Did not encounter water.

# APPENDIX C

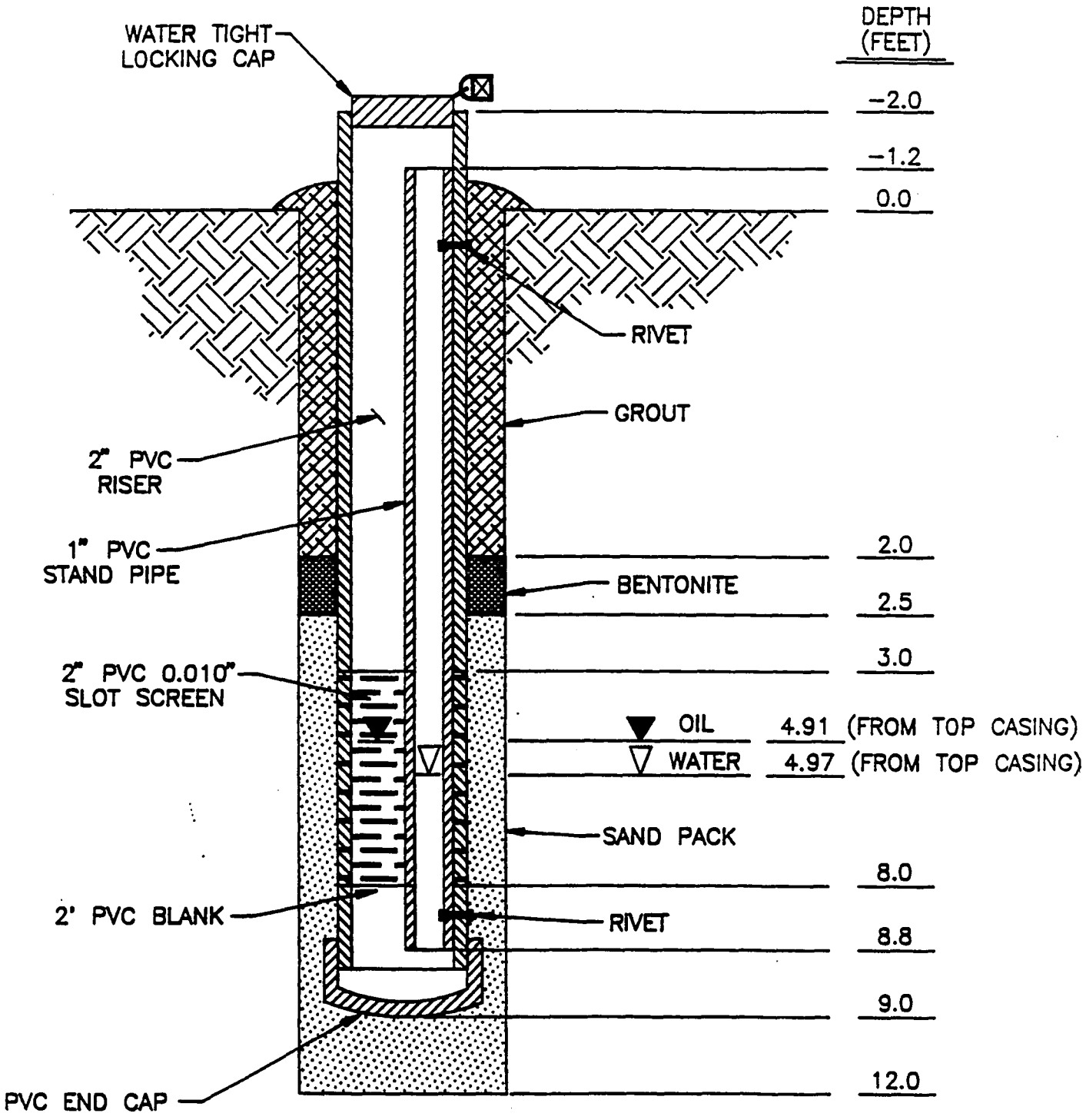
# SPECIAL PIEZOMETER CONSTRUCTION DETAILS

REMCOR

TEST BORING TB-8

PROJECT: 89118

# PIEZOMETER FOR OIL THICKNESS DETERMINATION




NOTES:

1. BOTH OIL AND WATER LEVELS ARE MEASURED TO TOP OF OUTER 2" PVC RISER.
2. DO NOT SCALE THIS DRAWING.

REMCOR, Inc. • 701 Alpha Drive • P.O. Box 38310 • Pittsburgh, PA 15238-8310 • 412-963-1106

June 7, 1991

Project No. 89118.5

Mr. Charles J. Fillinger
Senior Mechanical Engineer
Armco - Midwestern Steel Division
7000 Roberts Avenue
Kansas City, MO 64125

Transmittal
Boring Logs/Well Construction Diagrams
K.C. Southern Oil Tank Area

Dear Mr. Fillinger:

As per your recent request, Remcor, Inc. (Remcor) has provided the boring logs/well completion diagrams for the wells at the K.C. Southern Oil Tank Area. Attached to this letter please find copies of the logs for Wells RW-1, RW-2, and RW-3.

I trust that this submittal satisfies your requirements at this time. Remcor anticipates completion of a report for this project by June 28, 1991. If you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,

Dayne M. Crowley
Project Hydrogeologist

DMC:jrf
Attachments

REMCOR

# TEST BORING AND MONITORING WELL CONSTRUCTION LOG



| | | |
|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO - Oil Tank | |
| BORING NUMBER: RW-1 | COORDINATES: | DATE: |
| ELEVATION: | GWL: DEPTH DATE/TIME | DATE STARTED: 12/11/89 |
| GEOLOGIST/ENGINEER: Crowley | DEPTH DATE/TIME | DATE COMPLETED: |
| DRILLING METHODS: Air Rotary 9 7/8" Bit | | |

| DEPTH FEET | SAMPLE TYPE & NO. | BLOWS PER 6" | RECOVERY ( ) | DESCRIPTION | SOIL/ROCK TYPE | REMARKS | MONITORING WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|
| | | | | Slag / Bricks | | Bentonite cement | -3.5' |
| | | | | Fine Scale | | 6" DIA SCH 40 PVC RISER | |
| 5 | | | | Slag | Fill | | |
| 10 | | | | WET AT 10' | | SAND PACK | |
| | | | | | | 6" DIA PVC wire wrap 0.020 Slot Screen | |
| 15 | | | | Black Clayey silt | ML | 6" DIA. PVC End Plug | |
| | | | | ↑ Bottom of Boring 18.0' | | | |
| 20 | | | | | | | |

REMCOR

# TEST BORING AND MONITORING WELL CONSTRUCTION LOG

PAGE 1 OF 1

| | | |
|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO Oil TANK | |
| BORING NUMBER: RW-2 | COORDINATES: | DATE: |
| ELEVATION: | GWL: DEPTH DATE/TIME | DATE STARTED: 12/14/89 |
| GEOLOGIST/ENGINEER: | DEPTH DATE/TIME | DATE COMPLETED: |
| DRILLING METHODS: Air Rotary 9 7/8" Bit | | |

| DEPTH FEET | SAMPLE TYPE & NO. | BLOWS PER 6" | RECOVERY ( ) | DESCRIPTION | SOIL/ROCK TYPE | REMARKS | MONITORING WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|
| | | | | Fill material: Slag / Bricks | Fill | Bentonite Cement; 4" DIA SCH40 PVC RISER; Bentonite Pellets; SAND PACK; 4" DIA PVC 0.020" Mill SLOT SCREEN; 4" DIA PLUG | -2.0' |
| | | | | wet at 11' | | | |
| | | | | Black Clayey silt. | ML | | |
| | | | | Bottom of Boring @ 22' | | | |

5 10 15 20

RW-2

REMCOR

# TEST BORING AND MONITORING WELL CONSTRUCTION LOG

PAGE 1 OF 1

| | | |
|---|---|---|
| PROJECT NUMBER: 89118 | PROJECT NAME: ARMCO - OIL TANK | |
| BORING NUMBER: RW-3 | COORDINATES: | DATE: |
| ELEVATION: | GWL: DEPTH DATE/TIME | DATE STARTED: 12/14/89 |
| GEOLOGIST/ENGINEER: Crowley | DEPTH DATE/TIME | DATE COMPLETED: |
| DRILLING METHODS: Air Rotary 9 7/8" Bit | | |

| DEPTH FEET | SAMPLE TYPE & NO. | BLOWS PER 6" | RECOVERY ( ) | DESCRIPTION | SOIL/ROCK TYPE | REMARKS | MONITORING WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|
| 5 | | | | Fill Material: Slag / Bricks | Fill | Bentonite Cement; 4" DIA SCH40 PVC RISER; Bentonite Pellets | -2.5' |
| 10 | | | | | | SAND PACK; 4" DIA PVC 0.020" Mill Slot Screen | |
| 15 | | | | WATER @ 14' | | | |
| | | | | Black Silty Clay | ML | 4" DIA PLUG | |
| 20 | | | | ↑ Bottom of Boring @ 22' | | | |

RW-3